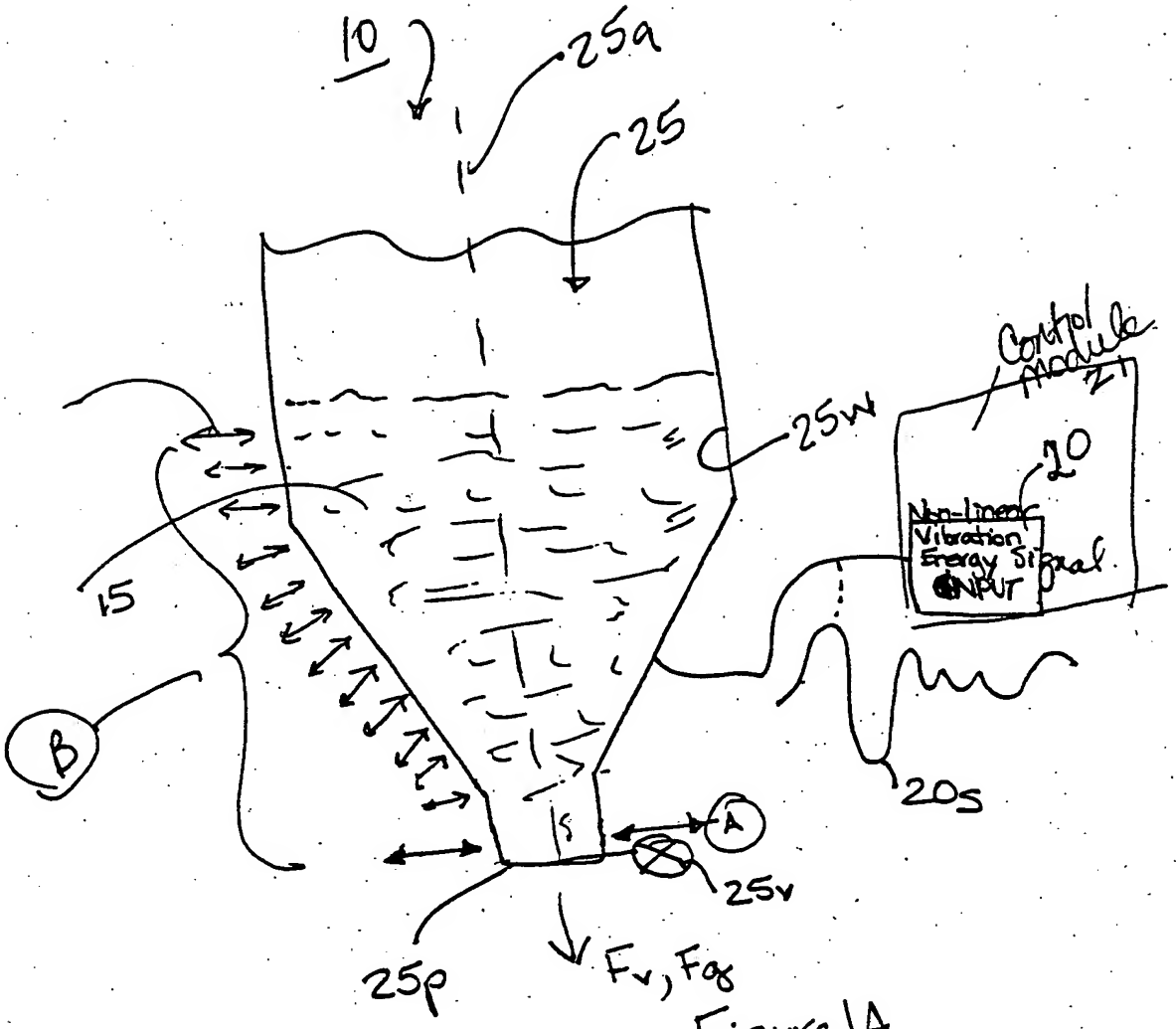

10
25a
25
Control Module 21
20
Non-Linear Vibration Energy Signal INPUT
25w
15
B
A
25v
25p
F_v, F_{ag}
20s

Figure 1A

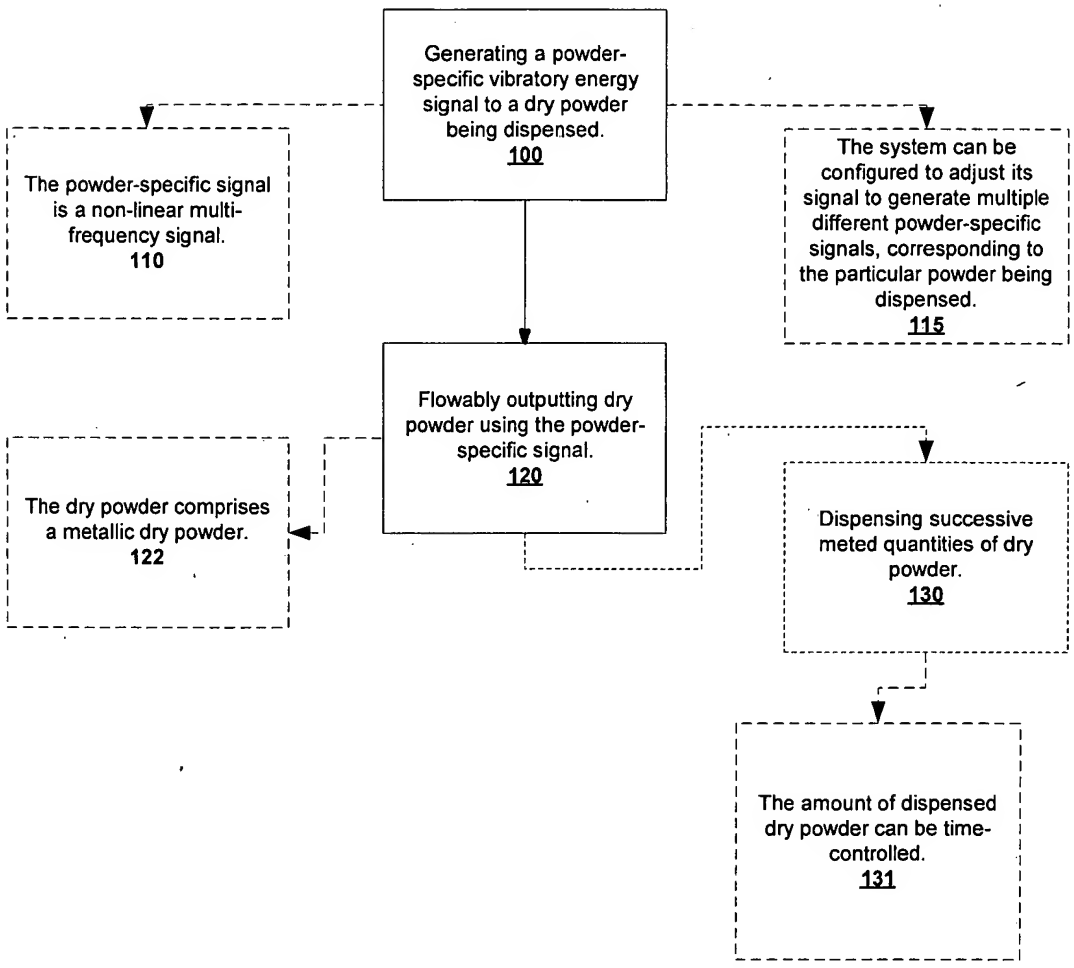

Generating a powder-specific vibratory energy signal to a dry powder being dispensed.
100
The powder-specific signal is a non-linear multi-frequency signal.
110
The system can be configured to adjust its signal to generate multiple different powder-specific signals, corresponding to the particular powder being dispensed.
115
Flowably outputting dry powder using the powder-specific signal.
120
The dry powder comprises a metallic dry powder.
122
Dispensing successive meted quantities of dry powder.
130
The amount of dispensed dry powder can be time-controlled.
131

FIGURE 1B

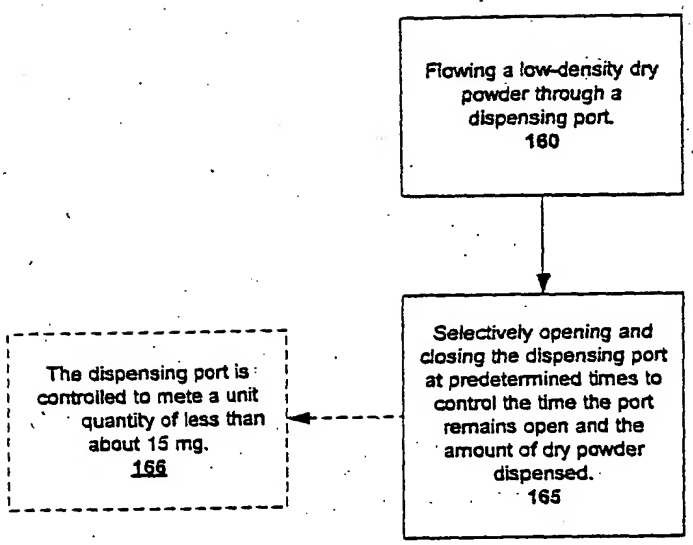
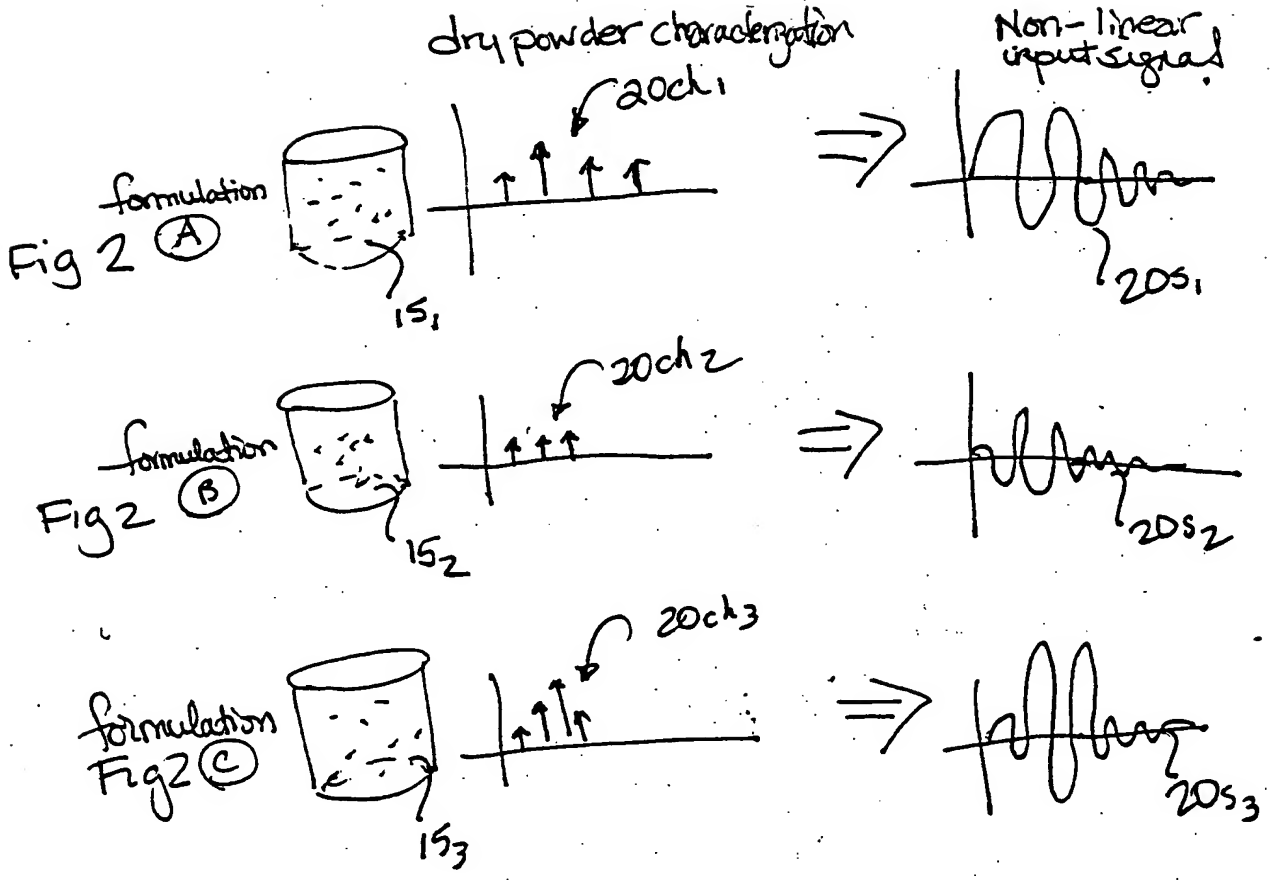

Flowing a low-density dry powder through a dispensing port.
160
Selectively opening and closing the dispensing port at predetermined times to control the time the port remains open and the amount of dry powder dispensed.
165
The dispensing port is controlled to mete a unit quantity of less than about 15 mg.
166

FIGURE 1C


dry powder characterization
Non-linear input signal
20ch1
formulation
A
Fig 2
15₁
20S₁
20ch2
formulation
B
Fig2
15₂
20S₂
20ch3
formulation
Fig2 C
15₃
20S₃

SIGNAL GENERATION ALGORITHM

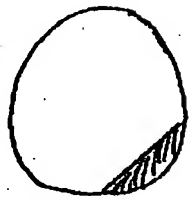


Fig. 3A

Measure time between avalanches for powders in Rotating drum

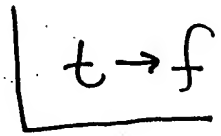


Fig. 3B

convert time to frequency space

Fig. 3C

plot distribution of frequencies

Fig. 3D

Record top six most observed frequencies, typically representing 75% of distribution

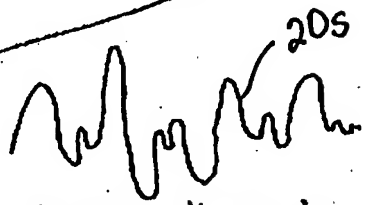
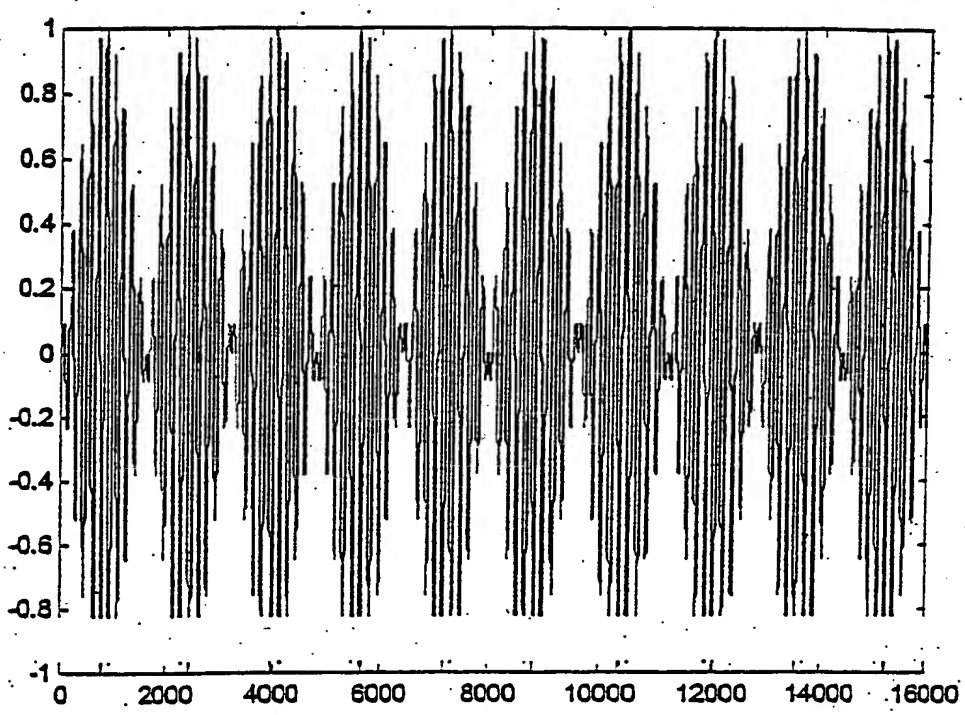


Fig. 3E

Superimpose these six frequencies to construct a single superposition signal (can include step of adjusting relative amplitudes)

FIGURE 14


1
0.8
0.6
0.4
0.2
0
-0.2
-0.4
-0.6
-0.8
-1
0
2000
4000
6000
8000
10000
12000
14000
16000

6

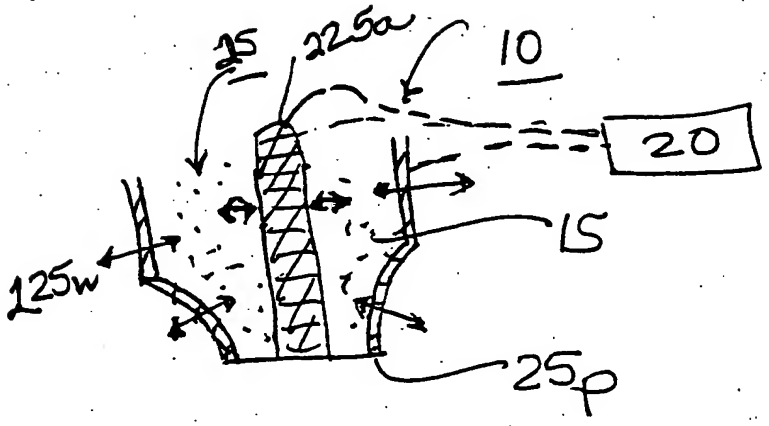

25
225a
10
20
15
125w
25p

Fig. 5A

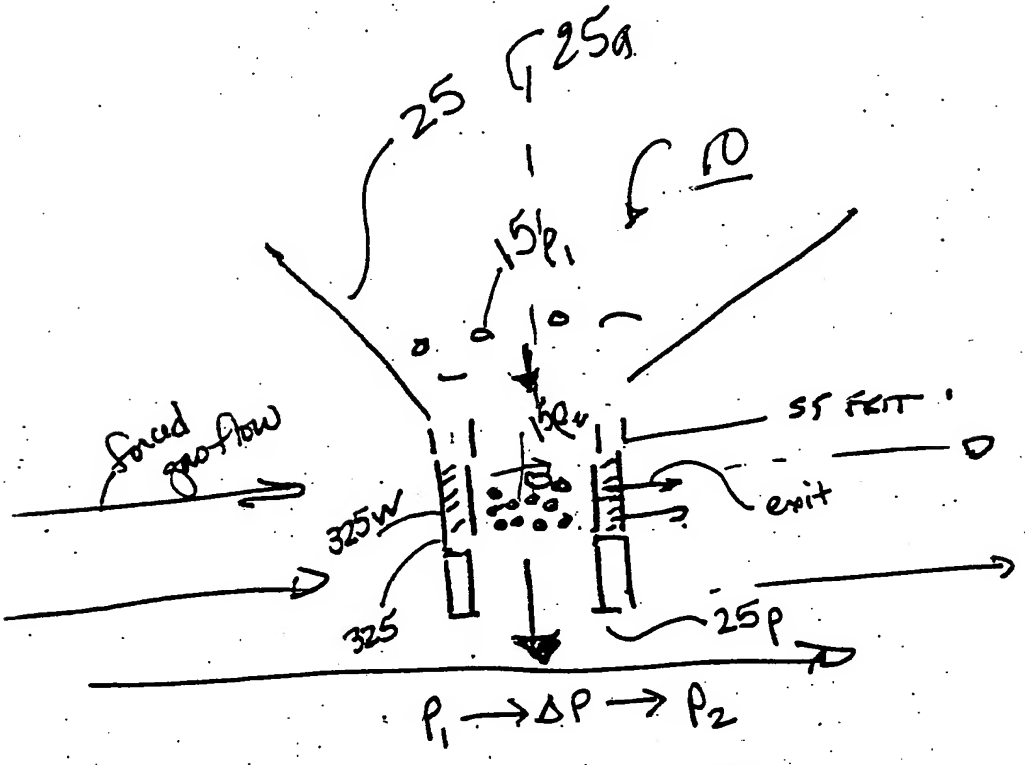

25a
25
10
15p1
15p2
55 exit
forced gas flow
325w
exit
325
25p
P1 → ΔP → P2

Fig. 5B

NON-LINEAR . VIBRATION / CENTRIFUGATION PRINCIPLE OF POWDER FILLING.

BASIC PRINCIPLE :

COMBINE NON-LINEAR FUNCTION WITH CENTRIFUGAL MOTION

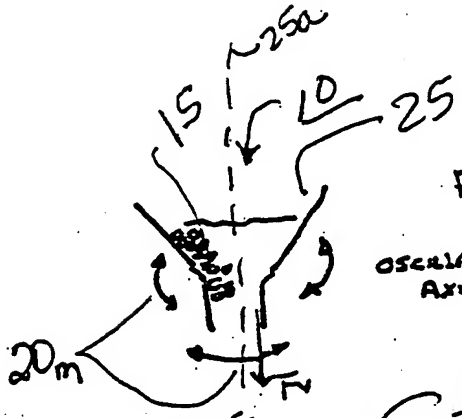


Fig.6

THIS CAN BE ADAPTED TO LOCAL NON-LINEAR VIBRATION.

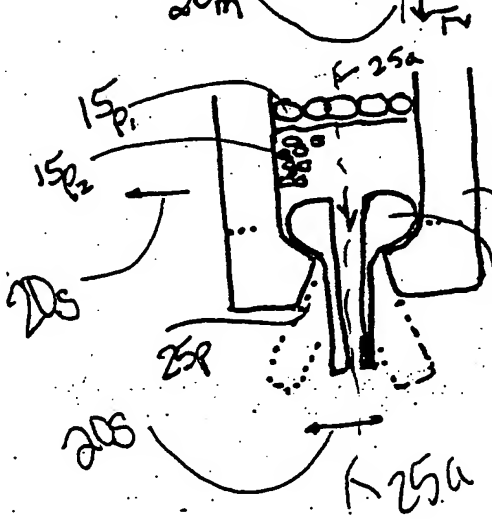


Fig.7

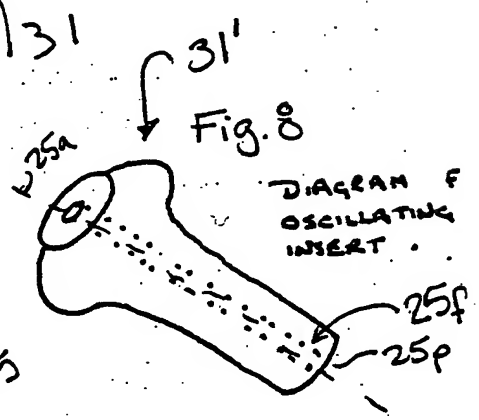


Fig.8

VIBRATION CAN BE APPLIED TO A RACK OF HEADS FILLING FROM SINGLE HOPPER.

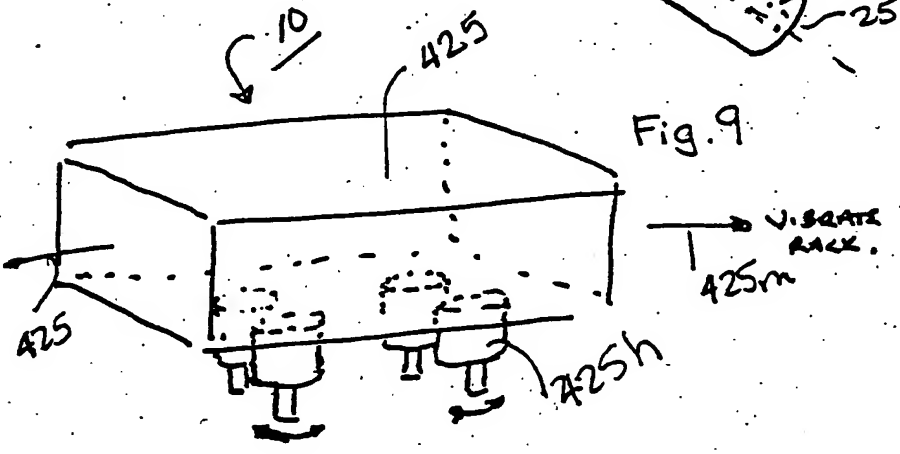


Fig.9

RADIUS (OR EXTREMES) OF MOTION CAN BE VERY SMALL. AT HIGH FREQUENCY THE ANGULAR VELOCITY WILL BE SUFFICIENT TO GIVE DIRECTIONAL ACCELERATION TO PARTICLES.

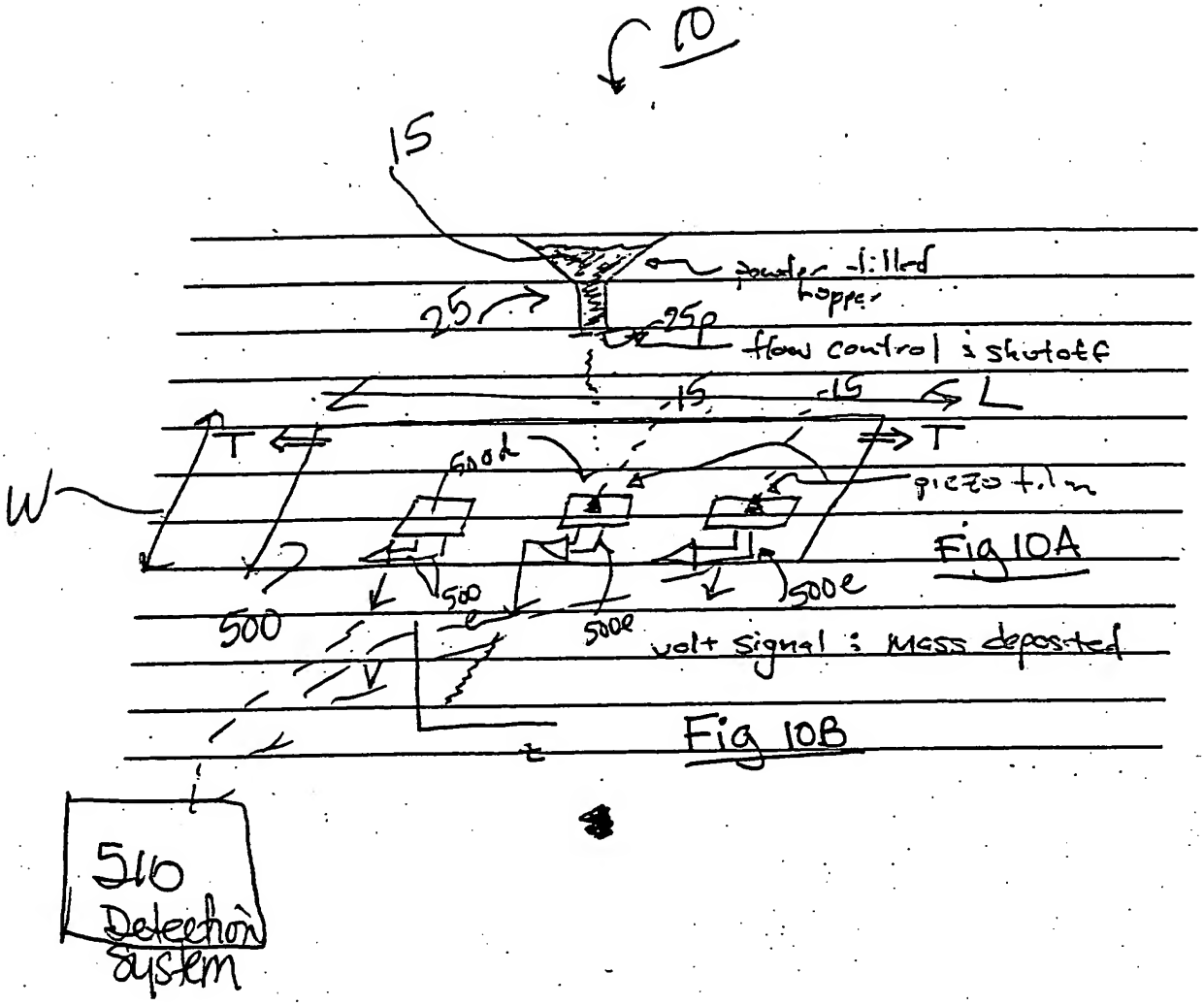


Fig 10A

Fig 10B

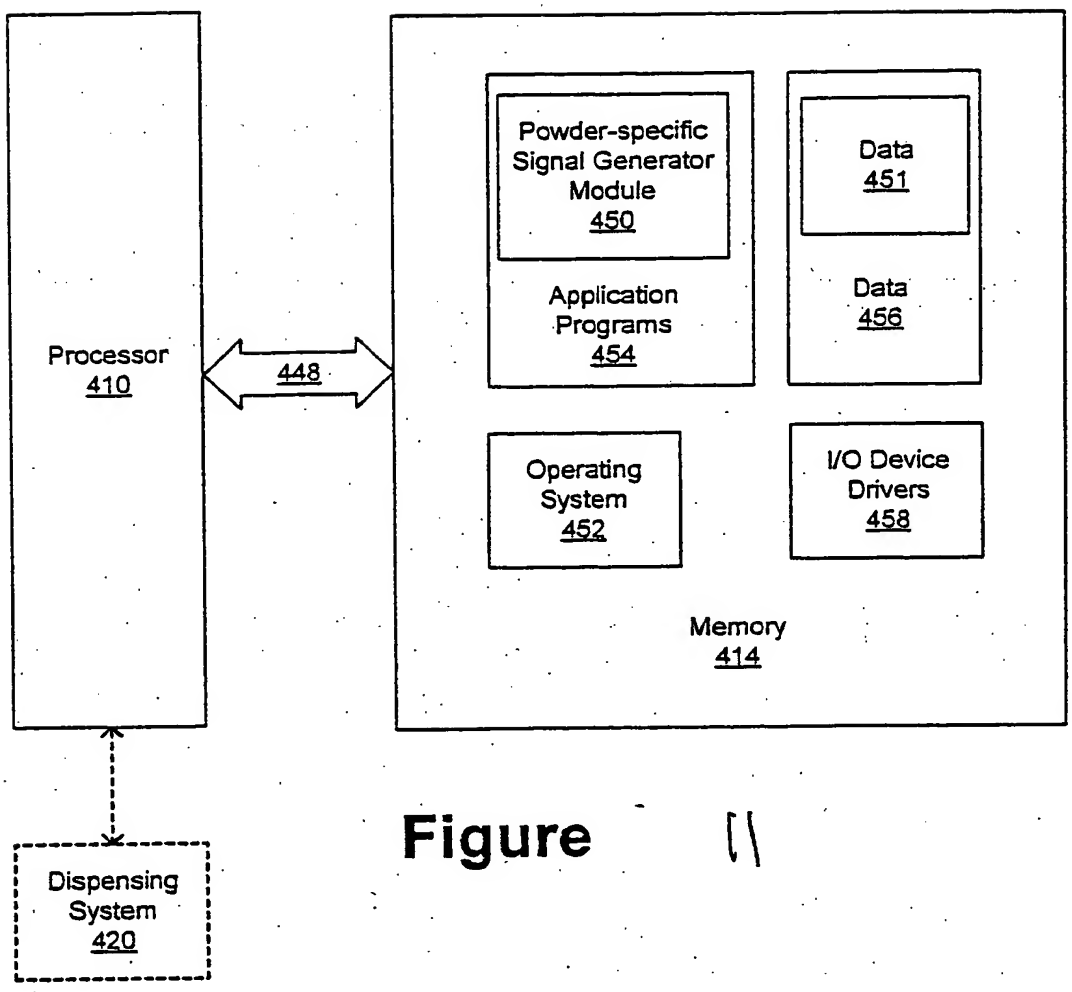

Processor
410
448
Powder-specific
Signal Generator
Module
450
Application
Programs
454
Data
451
Data
456
Operating
System
452
I/O Device
Drivers
458
Memory
414
Dispensing
System
420

Figure 1

FIGURE 12

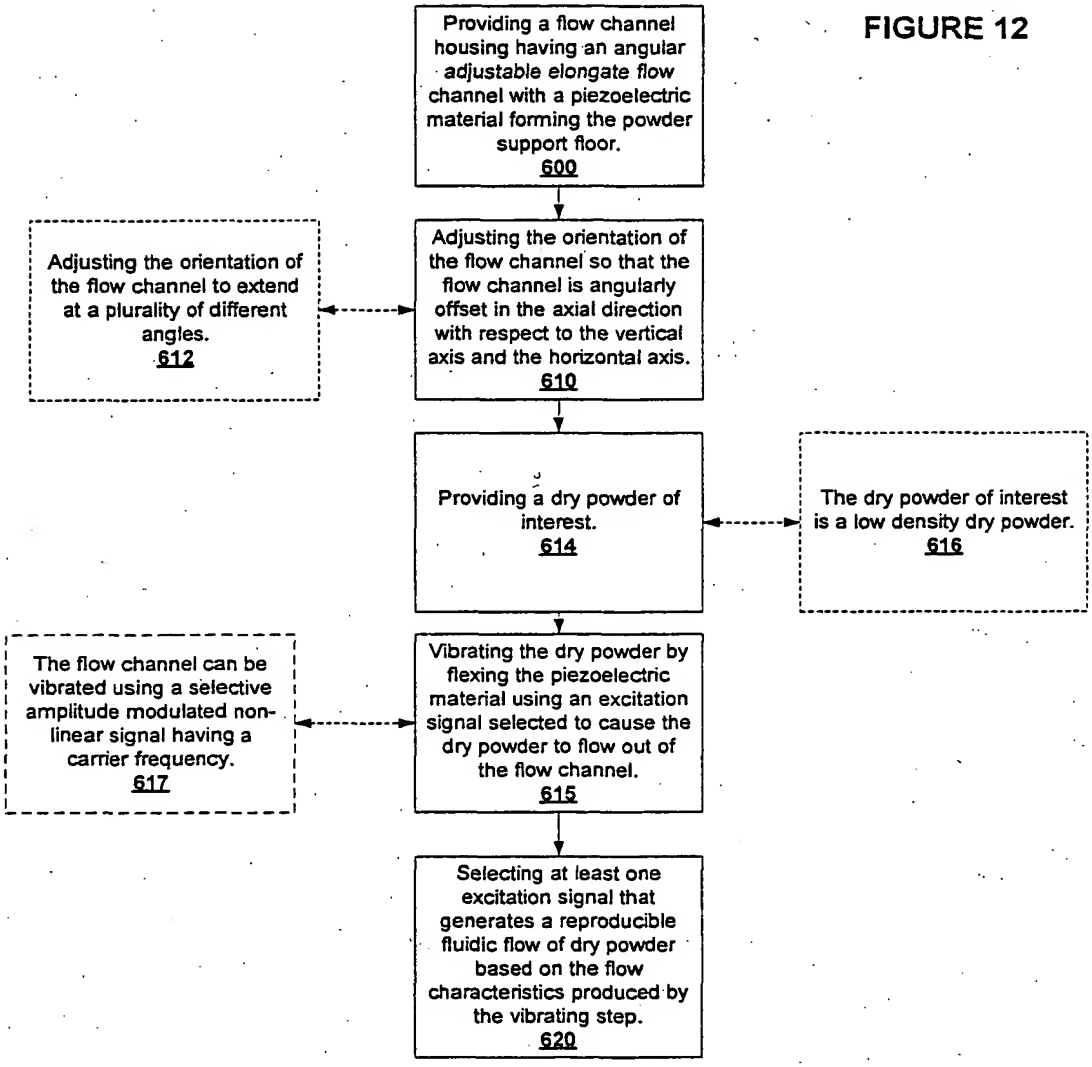
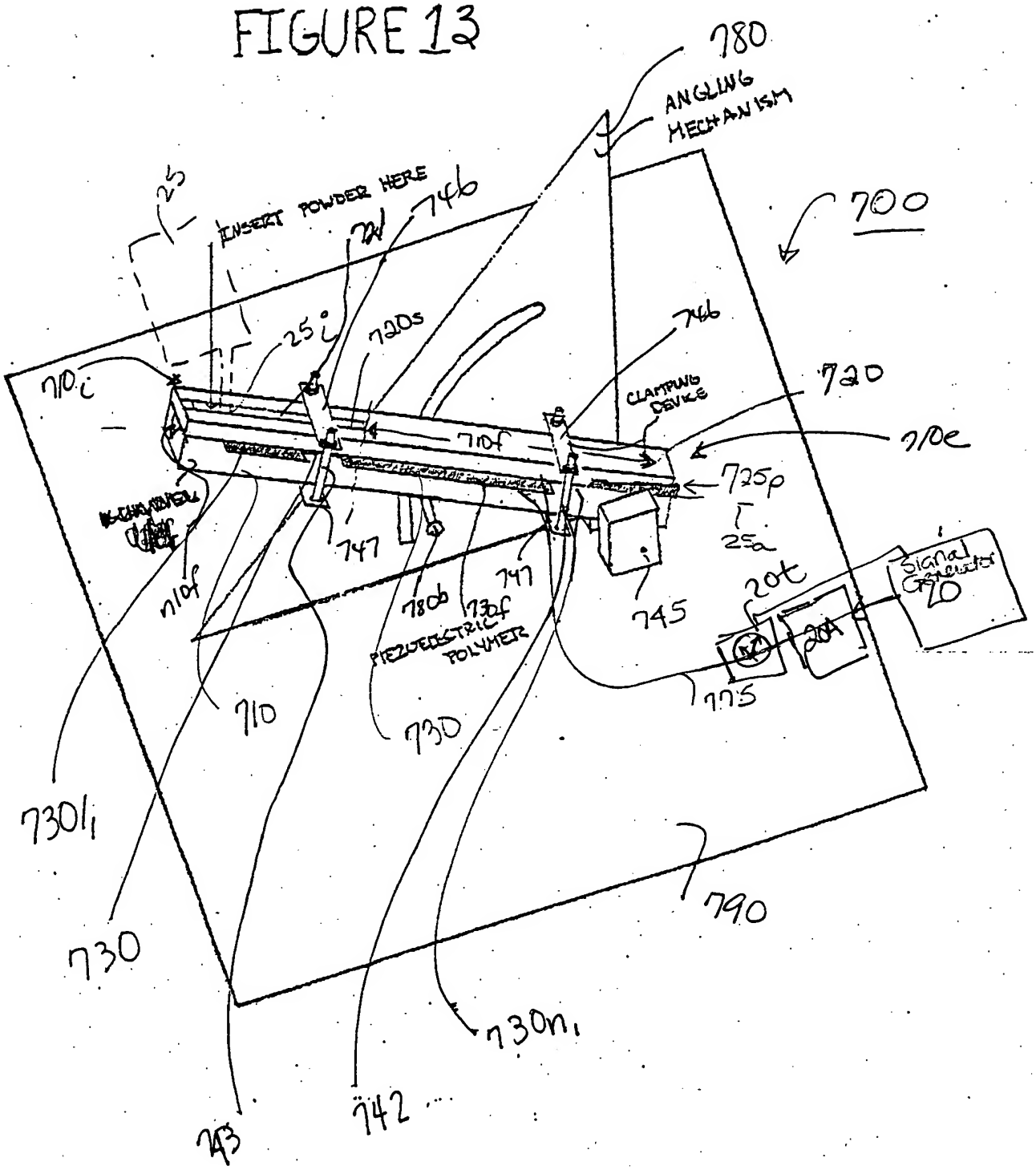

Providing a flow channel housing having an angular adjustable elongate flow channel with a piezoelectric material forming the powder support floor.
600
Adjusting the orientation of the flow channel so that the flow channel is angularly offset in the axial direction with respect to the vertical axis and the horizontal axis.
610
Adjusting the orientation of the flow channel to extend at a plurality of different angles.
612
Providing a dry powder of interest.
614
The dry powder of interest is a low density dry powder.
616
Vibrating the dry powder by flexing the piezoelectric material using an excitation signal selected to cause the dry powder to flow out of the flow channel.
615
The flow channel can be vibrated using a selective amplitude modulated non-linear signal having a carrier frequency.
617
Selecting at least one excitation signal that generates a reproducible fluidic flow of dry powder based on the flow characteristics produced by the vibrating step.
620

FIGURE 13


780
ANGLING MECHANISM
700
INSERT POWDER HERE
746
720s
720
CLAMPING DEVICE
710e
725p
747
745
775
710
730
730n
742
743
790
PIEZOELECTRIC POLYMER
Signal Generator
20
20A

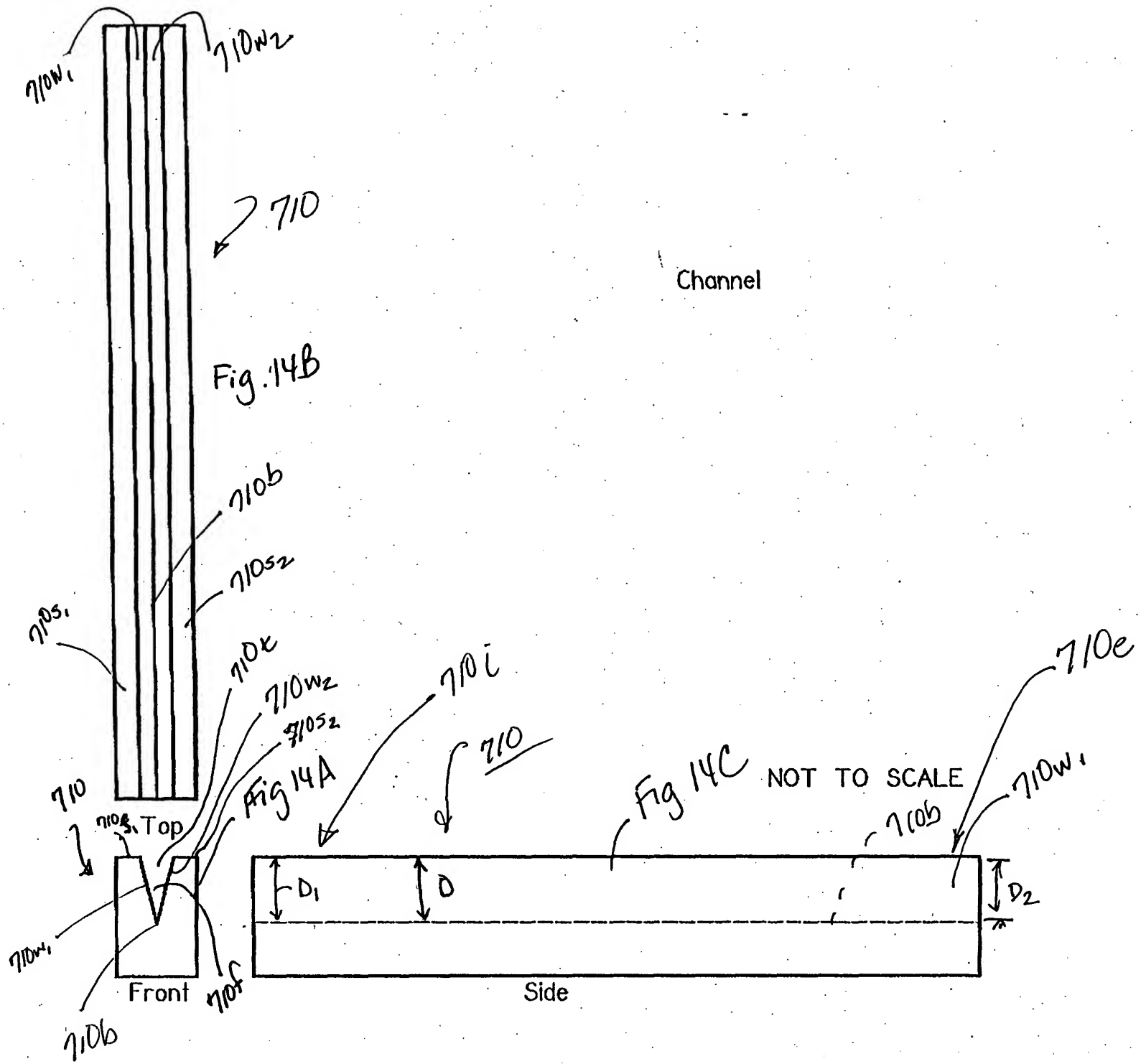


Fig. 14B

Fig 14A

Fig 14C

NOT TO SCALE

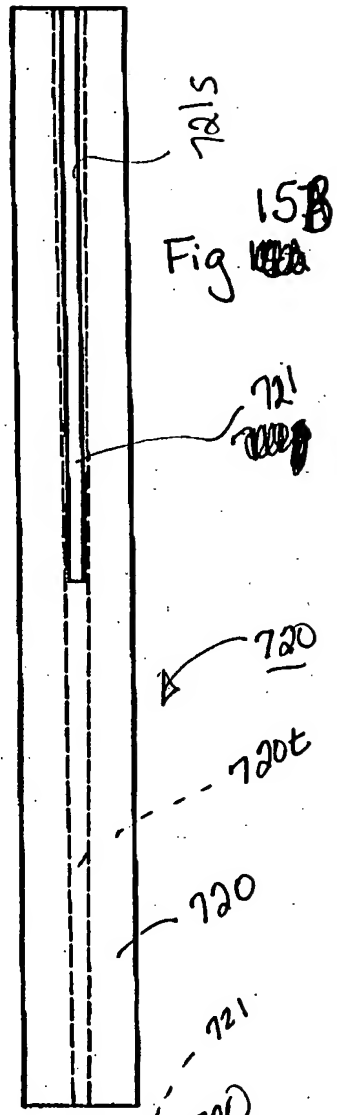


Fig 15B

Fig 15A

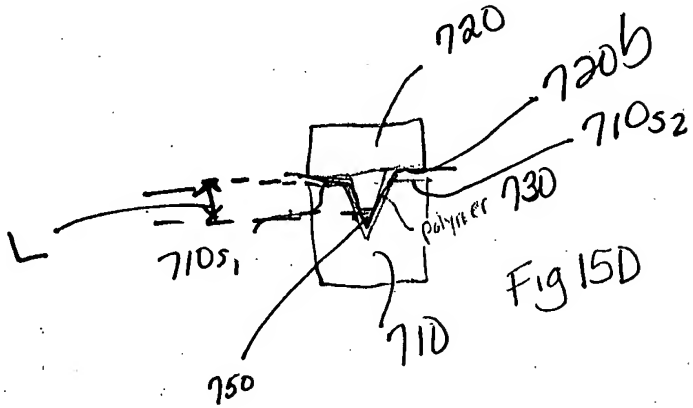


Fig 15D

NOT TO SCALE

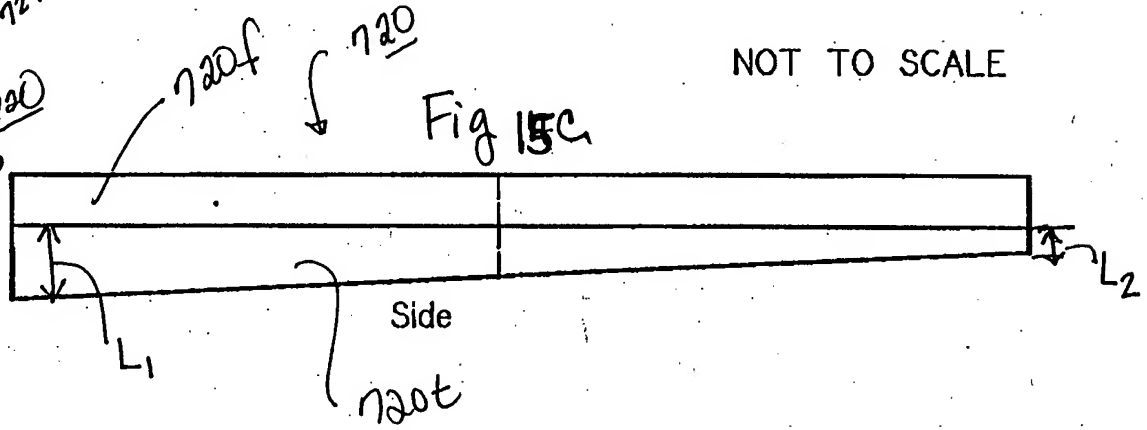


Fig 15C

Part 3: Piezoelectric Polymer
NOT TO SCALE

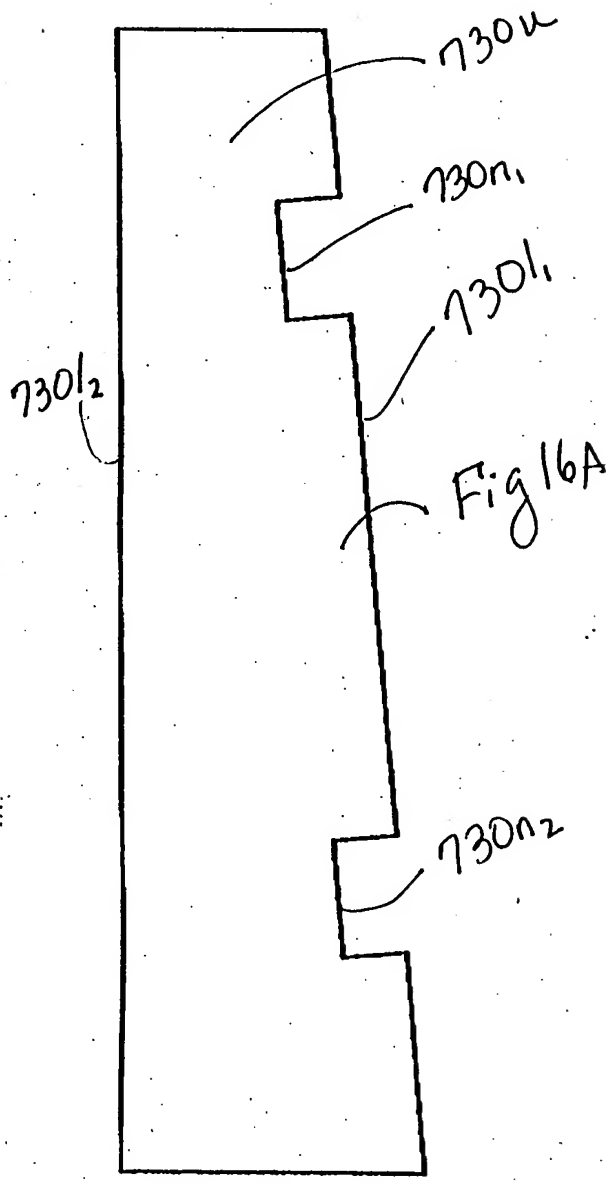


Fig 16A

NOT TO SCALE

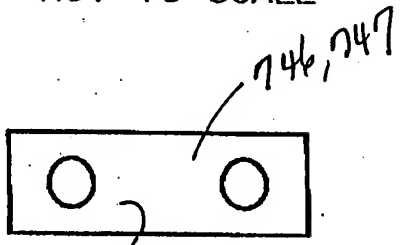


Fig 16B

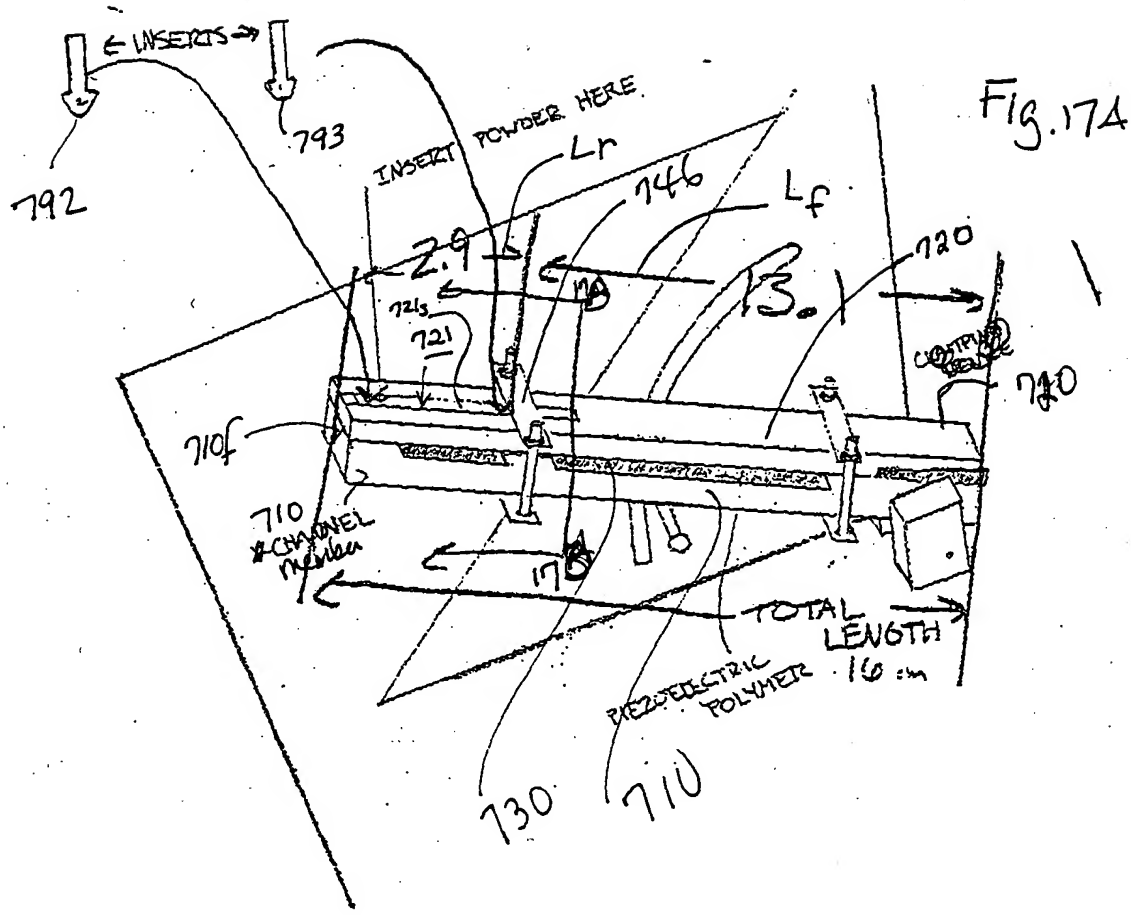


Fig. 17A

Fig. 17B